REMARKS

Claims 1-100 are pending in this application. Claims 1-2, 4, 8, 11, 14-21, 24-27, 29, 33, 36, 39-45, 49-52, 54, 58, 61, 64-70, 74-77, 79, 83, 86, 89-96, 99, and 100 stand rejected under 35 U.S.C. 103(a) as being obvious over DeKoning in view of Yoo et al. (U.S. Patent No. 5,866,451). Claims 3, 6, 7, 9, 10, 12, 13, 28, 31, 32, 34, 35, 37, 38, 53, 56, 57, 59, 60, 62, 63, 78, 81, 82, 84, 85, 87, and 88 stand rejected under 35 U.S.C. 103(a) as being unpatentable over DeKoning and Yoo and further in view of Courtright, II et al. (U.S. Patent No. 6,105,103). Claims 5, 22, 30, 47, 55, 72, 80, and 97 stand rejected under 35 U.S.C. 103(a) as being unpatentable over DeKoning and Yoo, and further in view of Mittal (U.S. Patent No. 5,829,025). Claims 23, 47, 48, 72, 73, 97, and 98 stand rejected under 35 U.S.C. 103(a) as being unpatentable over DeKoning and Yoo in view of Mittal.

Specification Objections

The disclosure stands objected to because of the following informality: the serial number and patent number of related applications are missing on page 2.

An amendment to the specification is submitted herewith. This amendment inserts the patent numbers for those applications that have issued as patents.

Claim Amendments

Claims 1, 26, 51 and 76 have been amended to make it clear that data may be flushed from the first level cache directly to either the second level cache or to the storage level. Support for the amendment is provided by pages 15 to 16 of the present application, including particularly fig. 5b. No new matter has been added.

Claim Rejections -- 35 U.S.C. §103(a)

Claims 1-2, 4, 8, 11, 14-21, 24-27, 29, 33, 36, 39-45, 49-52, 54, 58, 61, 64-70, 74-77, 79, 83, 86, 89-96, 99, and 100 stand rejected under 35 U.S.C. 103(a) as obvious over DeKoning (U.S. Patent No. 6,148,368) in view of Yoo et al.

The claims of the present application are not obvious over DeKoning in view of Yoo because the combination does not teach a first level storage cache coupled with a log-structured second level cache where either cache may be flushed directly to a main storage region. DeKoning teaches first and second level log structured storage caches. DeKoning's first level cache is flushed only to the second level cache, not to the main storage region. Yoo teaches a method of making static random access memory cells and logic on the same semiconductor device and only mentions caches in a passing reference to a first level random access cache in a microprocessor (the Intel 80486). Yoo teaches nothing about the organization of storage controllers and cannot remedy the deficit in DeKoning's teachings. Therefore, the combination of

DeKoning and Yoo does not teach the storage organization required by the claims.

Claim 1, as amended, requires:

A system for storing data, the system having one or more storage devices, the system comprising:

a first cache level for caching data from a sender into a first random-access structure;

a second cache level for caching data from the first cache level into a log structure; and

a storage level for storing data from the second cache level into a second random-access structure, wherein the storage level is also configured for storing data directly from the first cache level into the second random-access structure.

DeKoning neither teaches nor discloses that data in the first level cache may be flushed directly to the storage level. The ability to bypass the second level cache and flush data directly from the first level cache to the storage level provides a significant performance enhancement when the fragmentation of the second level cache slows system performance.

Yoo only discusses caches in a brief reference to the Intel 80486 microprocessor (see Yoo, col. 2, lines 15-19). The 80486 has a first level cache and no second level cache. Further, Yoo does not deal with caches in storage systems at all. Therefore, Yoo cannot provide the teachings that are lacking in DeKoning, e.g., a first level cache in a storage system flushed directly to either a second level cache or a main storage level.

Neither DeKoning nor Yoo teaches or discloses a system for storing data that includes "a storage level for storing data from the second cache level into a second random-access structure, wherein the storage level is also configured for storing data directly from the first cache level into the second random-access structure." To make obvious the embodiment of claim 1 of the present application, the combination of DeKoning and Yoo would have to teach or disclose a system meeting this limitation and the combination of DeKoning and Yoo does not. Thus, claim 1 of the present application is nonobvious over DeKoning in view of Yoo. Claims 2 through 25, which depend from claim 1 and add further limitations, are deemed nonobvious over DeKoning and Yoo for at least the same reasons as for claim 1.

Independent claims 26, 51 and 76 incorporate analogous limitations to the limitations cited above in claim 1. Since DeKoning and Yoo do not teach or disclose required limitations of claims 26, 51, and 76, DeKoning and Yoo cannot anticipate these claims. Dependent claims 27-50; 52-75; and 77-100 add further limitations to claims 26, 51 and 76 respectively and are deemed not anticipated by DeKoning and Yoo for at least the same reasons as for claims 26, 51 and 76.

<u>Claim Rejections -- 35 U.S.C. §103(a)</u>

Claims 3, 6, 7, 9, 10, 12, 13, 28, 31, 32, 34, 35, 37, 38, 53, 56, 57, 59, 60, 62, 63, 78, 81, 82, 84, 85, 87, and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over DeKoning and Yoo, and further in view of Courtright, II et al., (U.S. Patent No. 6,105,103).

Courtright discloses storing a logical to physical address map on the physical storage subsystem (e.g. disk array) rather than in the memory of the host computer. (See Courtright II, col. 2, lines 45 to 58.) The intent is to reduce the memory requirements on the host. Courtright neither teaches nor suggests the teaching, lacking in DeKoning and Yoo as shown above, of:

"a storage level for storing data from the second cache level into a second random-access structure, wherein the storage level is also configured for storing data directly from the first cache level into the second random-access structure."

Since neither DeKoning nor Yoo nor Courtright teaches these required limitations of claims 3, 6, 7, 9, 10, 12, 13, 28, 31, 32, 34, 35, 37, 38, 53, 56, 57, 59, 60, 62, 63, 78, 81, 82, 84, 85, 87, and 88, the combination of DeKoning, Yoo and Courtright cannot provide these teachings. Thus, these claims are deemed nonobvious over DeKoning and Yoo in view of Courtright.

Claims 5, 22, 30, 47, 55, 72, 80, and 97; and, 23, 47, 48, 72, 73, 97, and 98 are rejected under 35 U.S.C. 103(a) as obvious over DeKoning and Yoo, and further in view of Mittal (U.S. Patent No. 5,829,025). Mittal teaches a technique for providing hierarchical management of cache memories. (See Mittal, col. 2, line 62 to col. 3, line 13.) Mittal's method consists of including a cache locality hint within an instruction. None of Mittal's caches are log structured since these caches are between the execution unit 23a and main memory 11a (see Mittal fig. 5, for example). A log structured cache provides no benefit versus a random access cache in this organization. Mittal neither
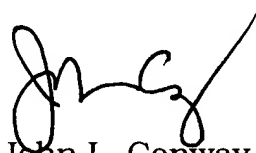
teaches nor suggests the teaching, lacking in DeKoning and Yoo as shown above, of:

"a storage level for storing data from the second cache level into a second random-access structure, wherein the storage level is also configured for storing data directly from the first cache level into the second random-access structure."

Since neither DeKoning nor Yoo nor Mittal teaches required limitations of claims, 5, 22, 30, 47, 55, 72, 80, and 97; and, 23, 47, 48, 72, 73, 97, and 98, the combination of DeKoning, Yoo and Mittal cannot provide these teachings. Thus, these claims are deemed nonobvious over DeKoning and Yoo in view of Mittal.

The Commissioner is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 19-4972. Applicants request reconsideration of all claims and a notice of allowance. The Examiner is requested to telephone the undersigned if any matters remain outstanding so that they may be resolved expeditiously.

Respectfully submitted,

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